

1     What is claimed is:

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3           1. A safety door system, for a hopper body containing a powered implement powered by a  
4     hydraulic motor in a hydraulic control system, comprising:

5           a hopper body having a V-shaped floor for transporting liquid or granular materials, and  
6     further including a powered implement for dispensing the liquid or granular materials from an opening  
7     in the hopper body or for agitating the liquid or granular materials;

8           a safety door for covering and preventing access into the hopper body during use, hinged  
9     along a first edge to a corresponding first side of the hopper body and moveable between a closed  
10    and an open position;

11          a hydraulic actuating cylinder coupled between a second edge of the safety door and a  
12    corresponding second side of the hopper body and operative to open the safety door when the  
13    hydraulic actuating cylinder extends its length and to close the safety door when the hydraulic  
14    actuating cylinder retracts its length; and

15          an interlock device coupled between the hydraulic actuating cylinder and the hydraulic control  
16    system such that the powered implement within the hopper body is prevented from operating  
17    whenever the safety door is not in a substantially closed position.

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19          2. The safety door system of claim 1, wherein the powered implement is a rotating screw  
20    conveyor for dispensing the liquid or granular materials from an opening in the hopper body.

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22          3. The safety door system of claim 2, wherein the screw conveyor is driven by a first hydraulic  
23    motor and mounted in the bottom of the hopper body for dispensing the liquid or granular materials  
24    from an outlet disposed in a lower-most portion of the V-shaped floor.

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26          4. The safety door system of claim 1, wherein the powered implement is a rotating paddle  
27    shaft for agitating the liquid or granular materials.

1           5. The safety door system of claim 3, wherein the paddle shaft is driven by a second  
2 hydraulic motor and located above the screw conveyer in the hopper body for agitating the liquid or  
3 granular materials.

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5           6. The safety door system of claim 1, wherein the liquid or granular materials include asphalt  
6 mix for repairing potholes in pavements.

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8           7. The safety door system of claim 1, wherein the hopper body is configured for transport on  
9 a truck chassis.

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11           8. The safety door system of claim 1, wherein the safety door system comprises a bifold door  
12 having first and second panel pairs operated respectively by first and second hydraulic cylinders.

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14           9. The safety door system of claim 1, wherein the safety door system comprises at least a  
15 single door panel operated by at least a single hydraulic cylinder.

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17           10. The safety door system of claim 1, wherein the safety door system comprises a multiple  
18 panel door operated by at least one hydraulic cylinder.

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20           11. The safety door system of claim 1, wherein the hydraulic cylinder changes its length in  
21 a direction approximately orthogonal to a radius arm formed by the door panel that pivots about the  
22 hinged first edge of the door panel as the door panel is opened or closed.

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24           12. The safety door system of claim 1, wherein the interlock device comprises:  
25 a solenoid-operated, normally open dump valve coupled in a supply path of hydraulic fluid  
26 to the hydraulic motor and operable to divert the flow of hydraulic fluid from the supply path to a  
27 fluid reservoir; and

1 a proximity switch coupled to the hydraulic cylinder such that contacts in the proximity switch  
2 operate the solenoid-operated, normally open dump valve before the hydraulic cylinder has extended  
3 its length by more than a predetermined amount as the door panel is opened.  
4

5 13. The safety door system of claim 12, wherein the interlock device causes interruption in  
6 the flow of hydraulic fluid to the hydraulic motor operating the rotating implement.  
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8 14. The safety door system of claim 13, wherein the predetermined amount is less than  
9 approximately ten percent.  
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11 15. The safety door system of claim 1, except that the interlock device is coupled between  
12 a predetermined location along an interface between the safety door and the hopper body and the  
13 hydraulic control system such that the powered implement within the hopper body is prevented from  
14 operating whenever the safety door is not in a substantially closed position against the hopper body.  
15

16 16. The safety door system of claim 15, wherein the interlock device comprises:  
17 a solenoid-operated, normally open dump valve coupled in a supply path of hydraulic fluid  
18 to the hydraulic motor and operable to divert the flow of hydraulic fluid from the supply path to a  
19 fluid reservoir; and

20 a proximity switch coupled to the predetermined location on the interface between the safety  
21 door and the hopper body such that contacts in the proximity switch operate the solenoid-operated,  
22 normally open dump valve before the separation between the safety door and the hopper body has  
23 increased by more than a predetermined amount as the door panel is opened to prevent entry by a  
24 person or a person's limb into the hopper body.  
25

26 17. The safety door system of claim 16, wherein the interlock device causes interruption in  
27 the flow of hydraulic fluid to the hydraulic motor operating the powered implement.  
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1           18. The safety door system of claim 13, wherein the predetermined amount does not exceed  
2 approximately four inches.

3  
4           19. A method of limiting access to a hopper body of a mobile pavement repair system during  
5 its use, the hopper body having an open top and a V-shaped floor, for transporting liquid or granular  
6 materials, wherein a powered implement powered by a hydraulic motor in a hydraulic control system  
7 is disposed within the hopper body, comprising the steps of:

8           covering the open top of the hopper body with a safety door, hinged along a first edge to a  
9 corresponding first side of the hopper body and operable between a closed and an open position;

10           opening and closing the safety door using a hydraulic actuating cylinder, the hydraulic  
11 actuating cylinder coupling the safety door from a second edge thereof to a corresponding second  
12 side of the hopper body, wherein the hydraulic actuating cylinder extends its length to open the safety  
13 door and retracts its length to close the safety door; and

14           preventing the powered implement from operating, whenever the safety door is not in its  
15 closed position, under the control of an interlock device coupled between the hydraulic actuating  
16 cylinder and the hydraulic motor.

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18           20. The method of claim 19, wherein the step of covering the open top of the hopper body  
19 comprises the step of configuring the safety door as a single panel door operated by at least a single  
20 hydraulic cylinder.

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22           21. The method of claim 19, wherein the step of covering the open top of the hopper body  
23 comprises the step of configuring the safety door as a bifold door having first and second door panel  
24 pairs wherein further each first and second bifold door panel pair is operated respectively by first and  
25 second hydraulic actuating cylinders.

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27           22. The method of claim 21, wherein each first and second pair of bifold door panels is  
28 hinged on opposite sides of the hopper body such that the bifold door pairs retract away from each  
29 other while being opened.

1           23. The method of claim 19, wherein the step of covering the open top hopper body  
2 comprises the step of configuring the safety door as a multiple panel door operated by at least one  
3 hydraulic actuating cylinder.  
4

5           24. The method of claim 19, wherein the step of opening and closing the safety door  
6 comprises the step of changing the length of the hydraulic actuating cylinder in a direction  
7 approximately orthogonal to a radius arm formed by the door panel that pivots about the hinged first  
8 edge of the door panel as the door panel is opened or closed.  
9

10          25. The method of claim 24, wherein the step of changing the length of the hydraulic  
11 actuating cylinder comprises the step of operating a lever coupled to a stack valve in the hydraulic  
12 control system.  
13

14          26. The method of claim 19, further comprising the step of configuring the interlock device  
15 according to the steps of:

16           coupling a solenoid-operated, normally open dump valve in a supply path of hydraulic fluid  
17 to the hydraulic motor and operable to divert the flow of hydraulic fluid from the supply path to a  
18 fluid reservoir; and

19           coupling a proximity switch to the hydraulic actuating cylinder such that contacts in the  
20 proximity switch operate the solenoid-operated, normally open dump valve before the hydraulic  
21 actuating cylinder has extended its length by more than a predetermined amount as the door panel is  
22 opened.  
23

24          27. The method of claim 26, further comprising the step of operating the interlock device to  
25 cause interruption in the flow of hydraulic fluid to the hydraulic motor in the hydraulic control system  
26 that is operating the powered implement.  
27

28          28. The method of claim 26, wherein the predetermined amount is less than approximately  
29 ten percent.

1           29. The method of claim 19, except that the step of preventing the powered implement from  
2 operating comprises the step of preventing the powered implement from operating whenever the  
3 safety door is not in its closed position against the hopper body under the control of an interlock  
4 device coupled between the interface between the safety door and the hopper body and the hydraulic  
5 motor.

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7           30. The method of claim 29, wherein the interlock device comprises:  
8           a solenoid-operated, normally open dump valve coupled in a supply path of hydraulic fluid  
9 to the hydraulic motor and operable to divert the flow of hydraulic fluid from the supply path to a  
10 fluid reservoir; and

11           a proximity switch coupled to the predetermined location on the interface between the safety  
12 door and the hopper body such that contacts in the proximity switch operate the solenoid-operated,  
13 normally open dump valve before the separation between the safety door and the hopper body has  
14 increased by more than a predetermined amount as the door panel is opened to prevent entry by a  
15 person or a person's limb into the hopper body.

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17           31. The method of claim 30, wherein the interlock device causes interruption in the flow of  
18 hydraulic fluid to the hydraulic motor operating the powered implement.

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20           32. The method of claim 30, wherein the predetermined amount does not exceed  
21 approximately four inches.

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23           33. The safety door system of claim 1, wherein the liquid or granular materials include  
24 magnesium chloride mixtures for conditioning icy road surfaces.

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26           34. The safety door system of claim 1, wherein the liquid or granular materials include  
27 agricultural materials for seeding crops or conditioning the soil.